Additives combined with ultrasound waves for a more efficient soil wash process?

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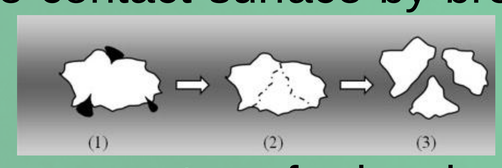
Problem

A classic soil wash process with water has its limitations leading to restrictions regarding contaminant concentration and soil structure of the incoming soils in a soil wash installation. A more efficient and powerful technique for soil washing is desired.
The addition of solubility enhancing or oxidizing agents can enhance the removal of organic contaminants such as mineral oil from soils, but they are often too expensive.

Aim

The purpose of this research is to examine whether additives are more efficient in removing oil from soils when combined with ultrasound waves (US). Ultrasound waves can enhance the leaching of contaminants by

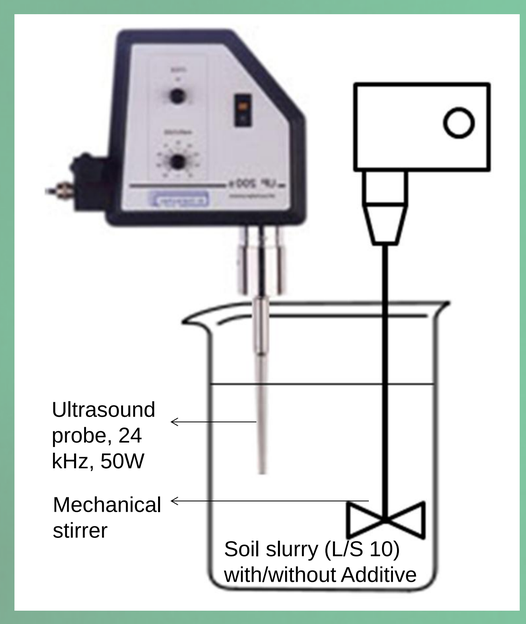
(i) increasing the contact surface by breaking up particles

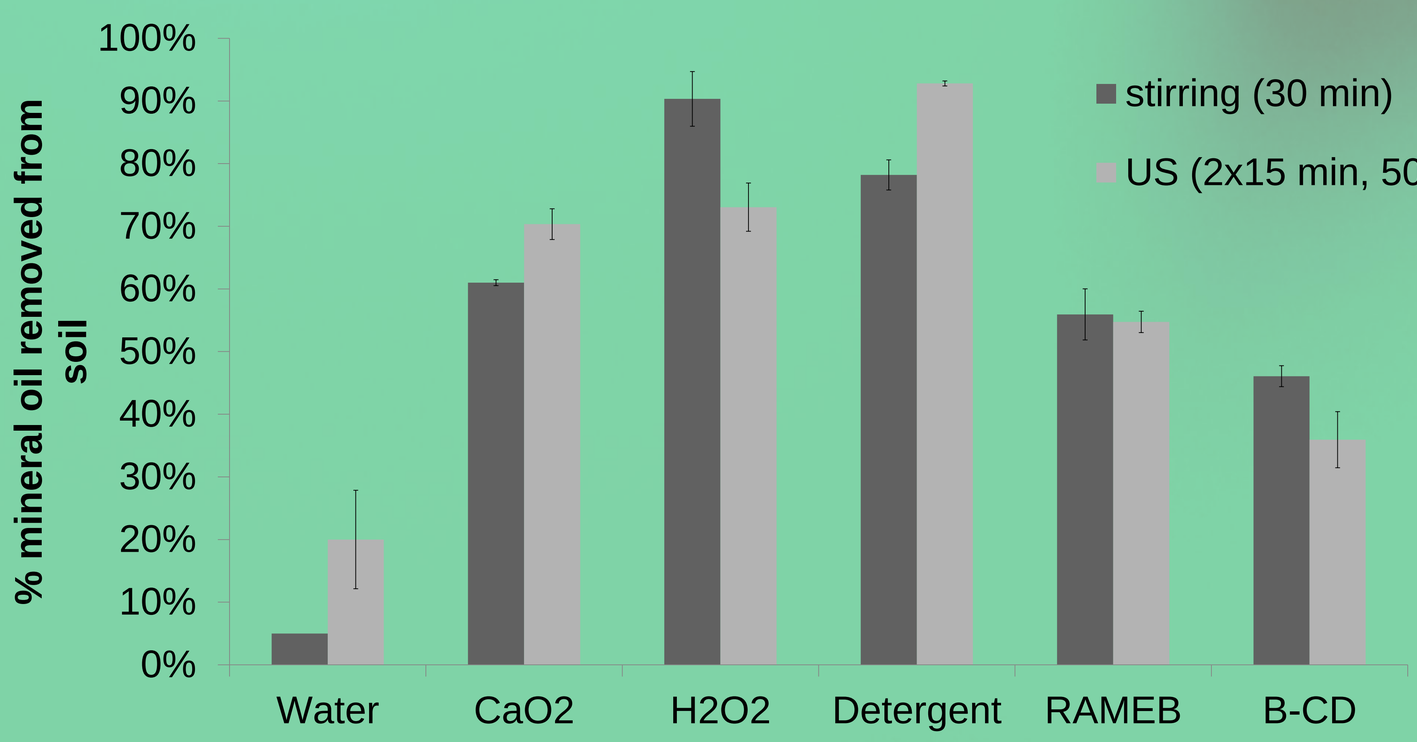


(ii) increasing the mass transfer by shock waves of collapsing cavitation bubbles.

Method and results

Additive	Type	Amount in the water (%)	Effect of US
Water	Reference	/	+
CaO_2	Oxidator (solid)	2	++
H_2O_2	Oxidator (liquid)	2	- -
Detergent	Solubility enhancer (liquid)	2	++
Randomly-methylated-beta-cyclodextrin (RAMEB)	Solubility enhancer (solid)	2	0
Beta-cyclodextrin (B-CD)	Solubility enhancer (solid)	2	-





Additives significantly enhance the removal of mineral oil from soil.

→ Without US:
Highest removal % is achieved with H_2O_2 (90%)

In general, the contribution of US on the removal efficiency remains limited

→ With US:
highest removal % is achieved with commercial available detergent (90%)

Conclusion

This research shows that ultrasound waves enhance the leaching effect for two out of five additives, leading to a higher removal of mineral oil from contaminated soil. However, in contrast to the tested additives, the contribution of US is limited.
And thus, the search for an economically interesting enhanced wash technique is still needed. Research to the efficient use of inexpensive additives remains necessary.